

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCA40214/PSC	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. <b>PCT/KR2004/001546</b>	International filing date (day/month/year) <b>25 JUNE 2004 (25.06.2004)</b>	Priority date (day/month/year) 26 JUNE 2003 (26.06.2003)	
International Patent Classification (IPC) or national classification and IPC <b>IPC7 H01L 33/00, H01L 21/20</b>			
Applicant <b>POSTECH FOUNDATION et al</b>			

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>2</u> sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>

Date of submission of the demand <b>21 APRIL 2005 (21.04.2005)</b>	Date of completion of this report <b>11 OCTOBER 2005 (11.10.2005)</b>
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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/KR2004/001546

## Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

This report is based on translations from the original language into the following language \_\_\_\_\_ which is the language of a translation furnished for the purposes of:

international search (under Rules 12.3 and 23.1(b))  
 publication of the international application (under Rule 12.4)  
 international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

the international application as originally filed/furnished

the description:  
 pages 1-8 \_\_\_\_\_ as originally filed/furnished  
 pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_  
 pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_

the claims:  
 pages \_\_\_\_\_ as originally filed/furnished  
 pages\* \_\_\_\_\_ as amended (together with any statement) under Article 19  
 pages\* 9-10 \_\_\_\_\_ received by this Authority on 21/04/2005  
 pages\* 9-10 \_\_\_\_\_ received by this Authority on 30/08/2005

the drawings:  
 pages 1-4 \_\_\_\_\_ as originally filed/furnished  
 pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_  
 pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_

the sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3.  The amendments have resulted in the cancellation of:

the description, pages \_\_\_\_\_  
 the claims, Nos. \_\_\_\_\_  
 the drawings, sheets \_\_\_\_\_  
 the sequence listing (*specify*) : \_\_\_\_\_  
 any table(s) related to sequence listing (*specify*) : \_\_\_\_\_

4.  This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

the description, pages \_\_\_\_\_  
 the claims, Nos. \_\_\_\_\_  
 the drawings, sheets \_\_\_\_\_  
 the sequence listing (*specify*) : \_\_\_\_\_  
 any table(s) related to sequence listing (*specify*) : \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Claims	1-11	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-11	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-11	YES
	Claims	NONE	NO

## 2. Citations and explanations (Rule 70.7)

## (1) Reference is made to the following documents:

D1 : "Selective MOCVD Growth of ZnO Natotips" IEEE Transactions on Nanotechnology, Vol. 2 No.1, pp50-54, MARCH 2003  
 D2 : EP 1258928 A1  
 D3 : KR 2001-70678 A  
 D4 : "ZnO nanotips grown on Si substrates by Metal-Organic Chemical-Vapor Deposition " Journal of Electronic Materials, Vol.33 No. 6 , pp 654-657, 01 June 2004

## (2) Novelty and Inventive Step

Claims 1-8, 11

The subject-matter of claim 1 is a nano device comprising a p-n heterojunction of a p-type semiconductor thin film and an n-type ZnO-based nanorods, wherein the free surface is filled with the insulating material.

D2-D3 disclose a heterojunction structure comprising a p-type semiconductor thin film and an n-type ZnO thin film. And D1 discloses a manufacturing method for making n-type ZnO nanotips on a GaN semiconductor layer and ZnO nanotips made by the said process.

But none of the documents D1-D4 refer to a nano device comprising ZnO-based nanorods and the insulating material (e.g. photoresist, polyimide etc.) which fills the free surface around the portions other than the tip portions of the ZnO nanorods. The tip portion of the nanorods is exposed by etching using a plasma in this application.

It is considered that D1-D4 are to be little relevant to the subject-matter of claim 1 and also to the the subject-matter of claims 2-8 which are dependent on claim 1.

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**Supplemental Box****In case the space in any of the preceding boxes is not sufficient.**

Continuation of:

BOX V.

And D1–D4 are considered to be little relevant to the subject-matter of claim 11 which is about an intergrated circuit comprising the nano device of claim 1.

**Claims 9–10**

The subject-matter of claims 9–10 is about a process for preparing the nano device of claim 1, which brings in vapor of Zn-containing metal organic compound and O<sub>2</sub> containing compound as reactants separately into contact with a p-type semiconductor thin film.

As mentioned above, none of the documents D1–D4 refer to a nano device comprising ZnO-based nanorods and the insulating material and the manufacturing method thereof.

So, it is considered that D1–D4 are to be little relevant to the subject-matter of claim 9 and also to the the subject-matter of claim 10 which is dependent on claim 9.

Consequently, compared with the prior arts as cited in the International Search Report, the present invention(claims 1–11) is believed to be novel and to involve an inventive step under PCT Article 33(2) and 33(3).

**(3) Industrial Applicability**

And the present invention has industrial applicability under PCT Article 33(4).